

REMARKS/ARGUMENTS

The Status of the Claims.

Claims 1-10, 12-13, 15-39 and 42 are pending with entry of this amendment, claims 40 and 41 being cancelled herein, and claims 11, 14 and 43-67 being cancelled in a previous amendment. Claim 39 is amended herein to correct a typographical error with respect to antecedent basis and is entirely formal in nature.

Claims 40 and 41 have been cancelled; cancellation of these claims is without prejudice, without intent to abandon any originally-claimed subject matter, and without intent to acquiesce in any rejection of record. Applicants expressly reserve the right to file one or more continuing applications containing these cancelled claims.

Applicants submit that no new matter has been added to the application by way of the above Amendment. Accordingly, entry of the Amendment is respectfully requested.

35 U.S.C. §112, Second Paragraph.

Claim 40 was rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite with respect to “whether or not the nanostructure is crossed.” Applicants submit that the rejection is moot in light of the cancelled claim and respectfully request that the rejection be withdrawn.

35 U.S.C. §102.

Claims 37-42 were rejected under 35 U.S.C. §102(e) as allegedly anticipated by Lieber et al. (USPN 7,211,464). Applicants traverse.

In order for a reference to anticipate an invention, the reference must teach each and every element of the claimed invention. Claims 37-42 are drawn to a plurality of clusters of structurally ordered nanostructures dispersed in a matrix on a surface of a substrate, in which the long axes of the nanostructures are aligned substantially parallel to the substrate surface.

Lieber is alleged to teach or disclose highly ordered nanowire structures having longitudinal axes disposed parallel to the surface of a substrate at column 15, lines 49-68. However, Lieber does not teach every element of the claimed invention. For example, the “plurality of elongated structures on a surface” as disclosed by Lieber at column 15 are not dispersed in a matrix. The methods described by Lieber and cited by the Office involve “depositing the plurality of elongated structures onto the surface” and “electrically charging the surface to produce electrostatic forces” among the deposited structures (column 15, lines 58-61). The electrostatic forces allegedly

cause the two or more elongated structures to align themselves into one or more patterns, such as a parallel array. The Office has not shown how the cited Lieber methods, which involve using electrostatic forces to align freestanding nanostructures, could be used to align nanostructures that are present in a matrix.

Lieber is also alleged to disclose nanowire structures disposed in a matrix at column 17, lines 36-60. In this instance, the Lieber methods involve dispersing the elongated structures within a flexible matrix and then stretching the matrix to produce a shear force. However, as noted above, the Lieber methods do not result in a matrix on a surface having nanostructures that are aligned substantially parallel to their long axes on the surface.

Since Lieber does not teach every element of the claimed invention, Applicants submit that the rejection is improper and respectfully request that it be withdrawn.

35 U.S.C. §103(a).

THE CLAIMS ARE PATENTABLE OVER MATYJASZEWSKI AND LIEBER

Claims 1-10, 12-13, 15-18 and 31 were rejected under 35 U.S.C. §103(a) as allegedly obvious in light of Matyjaszewski et al. (USPN 7,056,45) in view of Lieber et al. (USPN 7,211,464). Applicants traverse.

Three requirements must be met for a *prima facie* case of obviousness. First, the prior art reference must teach all of the limitations of the claims. M.P.E.P. § 2143.03. Second, there must be a motivation to modify the reference or combine the teachings to produce the claimed invention. M.P.E.P. § 2143.01. Third, a reasonable expectation of success is required. M.P.E.P. § 2143.02. The teaching or suggestion to combine and the expectation of success must be both found in the prior art and not based on Applicants' disclosure. M.P.E.P. §2143. Applicants respectfully submit that the cited art, alone or in combination, does not meet these criteria.

The limitations of the claimed invention are not taught by the cited art

First, the cited publications, alone or in combination, do not teach all of the limitations of the claimed invention. The rejected claims are drawn to compositions comprising a plurality of structurally ordered nanostructures in a matrix comprising one or more components that are chemically cross-linked or capable of chemically cross-linking to one or more of the nanostructures, wherein the nanostructures comprise group III-V, group II-VI or group IV semiconductors or alloys, and wherein the one or more matrix components interact to form a plurality of receiving structures capable of accommodating the nanostructures and providing ordering and/or orientation of the nanostructures.

Matyjaszewski is alleged to teach compositions comprising a plurality of structurally ordered nanostructures in a matrix comprising chemically crosslinkable nanostructures; however, this is incorrect. Matyjaszewski discloses processes for preparing nanoscale carbon-based structures via controlled pyrolysis of (carbon-based) polymer. Before pyrolysis, the Matyjaszewski composition could be considered to exist as a “matrix” of block copolymers. However, after pyrolysis, the polymer is gone, carbonized to form the described Matyjaszewski nanostructures. Matyjaszewski does not teach or describe structurally-ordered nanostructures in a matrix, much less a plurality of structurally ordered nanostructures in a matrix comprising one or more components that are chemically cross-linked or capable of chemically cross-linking to one or more of the nanostructures, wherein the nanostructures comprise group III-V, group II-VI or group IV semiconductors or alloys, and wherein the one or more matrix components interact to form a plurality of receiving structures capable of accommodating the nanostructures and providing ordering and/or orientation of the nanostructures.

The numerous passages specifically cited by the Office do not teach the elements of the claimed invention as alleged. The passage at column 8, lines 30-35 refers to crosslinking of phase-separated copolymer precursors, not matrix components cross-linked to nanostructures. At column 43, lines 23-29, Matyjaszewski refers to potentially crosslinking azide-containing precursors arranged in a brush-type (cylindrical) configuration with UV light, then performing pyrolysis to generate a hollow graphitic cylinder, also not comparable to the claimed structurally-ordered nanostructures in a matrix. At column 18, line 64 to column 19, line 4, Matyjaszewski refers to arrays of carbon nanostructures, including nanostructures comprising carbon, carbides, transition metals, and catalytic components. At column 20, lines 46-51 and column 21, lines 4-28, reference is made to arrays of carbon nanotubes. However, within this passage as cited by the Office, Matyjaszewski specifically mentions infusion of the “first formed two-dimensional array of nanostructures with monomers and polymeriz[ation of] the monomers in place” (column 20, lines 49-50). Thus, in addition to not teaching nanostructures comprising group III-V, group II-VI or group IV semiconductors or alloys as noted above, Matyjaszewski does not teach or disclose one or more matrix components that interact to form a plurality of receiving structures capable of accommodating the nanostructures and providing ordering and/or orientation of the nanostructures.

This deficit is not remedied by the Lieber publication. Lieber is alleged to disclose highly ordered nanowire structures having longitudinal axes disposed parallel to the substrate surface at column 12, line 65 and column 15, lines 49-68). However, Lieber does not teach or disclose matrices “comprising one or more components that are chemically cross-linked or capable of

chemically cross-linking to one or more of the nanostructures” or matrix components that “interact to form a plurality of receiving structures capable of accommodating the nanostructures and providing ordering and/or orientation of the nanostructures”; rather, the cited passages describe methods of assembling the Lieber elongated structures on a surface by depositing them and aligning using either electrostatic forces (column 15, lines 61-63) or shear forces (column 17, lines 46-50). Furthermore, the Lieber publication specifies that, after alignment of the Lieber elongated structures, the flexible matrix is removed, thus confirming that the matrix components are not chemically cross-linked (nor intended to be cross-linked) to a nanostructure.

Since the cited Matyjaszewski and Lieber publications, alone or in combination, do not teach all of the limitations of the claimed invention, the first criterion for proving a *prima facie* case of obviousness has not been met.

There is no motivation to modify Matyjaszewski or Lieber

The second criterion for proving a *prima facie* case of obviousness is there must be a motivation to modify the reference or combine the teachings to produce the claimed invention. First, there is no motivation to use the claimed nanostructures comprising group III-V, group II-VI or group IV semiconductors or alloys to perform the synthetic methods taught by Matyjaszewski. The Matyjaszewski publication is specifically directed to processes for the preparation of carbon-based structured materials via carbonization/pyrolysis (see Abstract), but one of skill in the art would recognize that pyrolysis would not be appropriate for synthesis of nanostructures comprising group III-V, group II-VI or group IV semiconductors or alloys as claimed. Furthermore, there is no motivation to attempt to incorporate a flexible matrix as provided in Lieber into the Matyjaszewski carbon-based structures. The Matyjaszewski structures have been aligned based upon the configuration assumed by the precursor copolymer component prior to pyrolysis; application of shear force to the flexible matrix as directed by Lieber would disorganize, not further align, the Matyjaszewski structures and would not produce the compositions of the claimed invention. Nor does either publication provide a motivation for producing the claimed compositions using the methods taught in Lieber, since the Lieber matrices neither comprise one or more components that are chemically cross-linked or capable of chemically cross-linking to the claimed nanostructures nor interact to form a plurality of receiving structures capable of accommodating the nanostructures.

Since there is no motivation to produce the claimed invention (beyond that found in the specification of the subject invention), Applicants submit that the second criterion for proving a *prima facie* case of obviousness has not been met.

There is not reasonable expectation of success

Third, a reasonable expectation of success is required for proving a *prima facie* case of obviousness, and this expectation must be both found in the prior art and not based on Applicants' disclosure. Applicants submit that one of skill in the art would not expect the pyrolytic methods for synthesis of carbon-based nanostructures as taught by Matyjaszewski to successfully produce the group III-V, group II-VI or group IV semiconductors/alloy type nanostructure-matrix compositions as claimed. Further, one of skill would expect that methods such as those taught in Lieber, involving stretching a flexible matrix to produce a shear force for purposes of alignment, would not work successfully with either the Matyjaszewski pyrolysis products (which are already ordered, based upon copolymer block orientations), or with matrices in which the components are chemically cross-linked to the embedded nanostructures, such as those of the claimed invention.

Applicants respectfully submit that, since the cited publications, alone or in combination, do not provide a reasonable expectation of success, the third criterion for proving a *prima facie* case of obviousness has not been met.

Summary

Since Matyjaszewski and Lieber, alone or in combination, do not meet the criteria for proving a *prima facie* case for obviousness (all of the claimed elements are not taught, there is no motivation to modify the cited art, nor is there a reasonable expectation of successfully producing the claimed invention based upon teachings in the cited art), Applicants submit that the claims are patentable over the cited art and respectfully request that the rejection be withdrawn.

THE CLAIMS ARE PATENTABLE OVER MATYJASZEWSKI, YING AND LIEBER

Claims 19-30 and 32-36 were rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Matyjaszewski in view of Ying et al. (USPN 5,958,367) and in further view of Lieber. Applicants traverse.

As noted above, a *prima facie* case of obviousness requires that the combination of the cited art, taken with the general knowledge in the field, must provide all of the elements of the claimed invention. When a rejection depends on a combination of prior art references, there must be some teaching, suggestion or motivation to combine the references. In re Geiger, 815 USPQ2s 1276, 1278 (Fed. Cir. 1987). Moreover, to support an obviousness rejection the cited references must additionally provide a reasonable expectation of success. In re Vaeck, 20 USPQ2d 1438 (Fed. Cir. 1991), citing In re Dow Chemical Co., 5 USPQ2d 1529, 1531 (Fed. Cir. 1988).

Matyjaszewski is alleged to teach various nanostructures, and Ying is alleged to disclose use of ligands for the purpose of stabilization; the Office acknowledges that neither

publication teaches compositions comprising group III-V, group II-VI or group IV semiconductors or alloys. Lieber is alleged to teach highly-ordered nanowire structures having longitudinal axes disposed parallel to a substrate surface, pluralities of nanostructure clusters, and nanowire structures in a matrix. However the cited publications, alone or in combination, do not meet the criteria for proving a *prima facie* case for obviousness. As such, the rejection is improper and should be withdrawn.

The limitations of the claimed invention are not taught by the cited art

Claims 19-30 and 32-36 are drawn to compositions comprising a plurality of structurally ordered nanostructures comprising group III-V, group II-VI or group IV semiconductors or alloys, and one or more alignment ligands associated with the nanostructures, and wherein a first alignment ligand on a first member nanostructure interacts with a second alignment ligand on an adjacent member nanostructure, thereby structurally ordering the plurality of nanostructures.

The Office has alleged that Matyjaszewski discloses the claimed invention including various shaped nanostructures (at column 16, lines 9-23) and ligands (at column 37, lines 53-55). Applicants respectfully submit that this allegation is incorrect; as noted herein, Matyjaszewski disclosed processes for preparing nanoscale carbon-based structures, not the claimed nanostructures comprising group III-V, group II-VI or group IV semiconductors or alloys. In addition, the “ligand” referred to at column 37, lines 53-54 of Example 5A (“The CuBr and the ligand were mixed in a 25mL Schenkli flask...”) is the butyl acrylate (BA) monomer used in the polymerization reaction to form the Matyjaszewski nanostructures, and not a ligand component to be associated with the nanostructure:

REAGENT	ROLE
CuBr and the polyamine PMDETA	Catalyst
DM-2,6-DBHD	Initiator
BA (butyl acrylate)	Monomer
anisole	Solvent

This is also clear upon review of the previous Examples, which refer to the same reaction components. Nowhere does Matyjaszewski teach or disclose “one or more alignment ligands associated with the nanostructures.”

The Office helpfully noted that neither Matyjaszewski nor Ying disclose the use of group III/V, group II/IV or group IV semiconductors and/or alloys, nor does either reference teach a

association of such semiconductors/alloys with first or second alignment ligands. This deficit is not remedied by the Lieber publication.

As noted above, Lieber describes methods of assembling elongated structures on a surface by depositing them and aligning using either electrostatic forces or shear forces generated using a flexible matrix. In the latter embodiment, the Lieber publication specifies that, after alignment of the Lieber elongated structures, the flexible matrix is removed from the compositions. Lieber does not teach or describe group III-V, group II-VI or group IV nanostructures associated with one or more alignment ligands that are chemically cross-linked or capable of chemically cross-linking to one or more of the nanostructures, or that interact with one another, thereby structurally ordering the plurality of nanostructures. Since Matyjaszewski, Ying and Lieber, alone or in combination, do not teach all of the limitations of the claimed invention, the first criterion for proving a *prima facie* case of obviousness has not been met.

There is no motivation to modify the cited art to produce the claimed invention

In addition to teaching all of the claimed elements, there must be a motivation to modify the reference or combine the teachings to produce the claimed invention (the second criterion for proving obviousness). The Office has not met its duty in providing such motivation. First, as noted above, there is no motivation to produce the claimed compositions using the Matyjaszewski methods as suggested by the Office: the Matyjaszewski pyrolysis is not appropriate for synthesis of nanostructures comprising group III-V, group II-VI or group IV semiconductors or alloys, or for syntheses involving alignment ligands as an additional component.

Second, there is no motivation to either replace the Matyjaszewski “ligands” (i.e., BA monomers) with, or further include, the surfactant ligands taught in Ying as suggested by the Office (page 5: “Ligands are used to stabilize a structure. Therefore it would have been obvious to one of skill in the art to be motivated to use ligands in the Matyjaszewski reference in order to have a more stabilized product.”) Such compositions would not withstand the pyrolysis step taught in the Matyjaszewski methods; furthermore, inclusion of the Ying surfactants ligands would disrupt, rather than enhance, the phase separation and self-organization required of the Matyjaszewski precursors for successful generation of ordered structures upon pyrolysis.

Furthermore, there is no motivation to attempt to “use the group III or group V semiconductors [of Lieber] in the Matyjaszewski reference in order to have miniaturization in the use of optoelectronic devices” as suggested by the Office (page 6), since, as noted above, such compositions would not produce the desired structured nanocompositions using Matyjaszewski’s synthesis methods designed for carbon-based components.

Since there is no motivation to produce the claimed invention (beyond that found in the specification of the subject invention), Applicants submit that the second criterion for proving a *prima facie* case of obviousness has not been met.

There is not reasonable expectation of success

The third criterion for proving a *prima facie* case of obviousness is a requirement for a reasonable expectation of success. As noted in the previous argument, this expectation must be both found in the prior art and not based on Applicants' disclosure. This requirement has also not been met by the Office. As noted above, one of skill in the art would not expect the pyrolytic methods for synthesis of carbon-based nanostructures as taught by Matyjaszewski to successfully produce the group III-V, group II-VI or group IV semiconductors/alloy type nanostructure-matrix compositions as suggested by the Office, even in the presence of additional components taught in Ying and/or Lieber. Furthermore, inclusion of the Ying surfactants ligands would disrupt, rather than enhance, the phase separation and self-organization required of the Matyjaszewski precursors for successful generation of ordered structures, thus further reducing any expectation of successfully producing the claimed compositions.

Applicants respectfully submit that, since the cited publications, alone or in combination, do not provide a reasonable expectation of success, the third criterion for proving a *prima facie* case of obviousness has not been met.

Summary

Since Matyjaszewski, Ying and Lieber, alone or in combination, do not meet the criteria for proving a *prima facie* case for obviousness (all of the claimed elements are not taught, there is no motivation to modify the cited art, nor is there a reasonable expectation of successfully producing the claimed invention based upon teachings in the cited art), Applicants submit that the claims are patentable over the cited art and respectfully request that the rejection be withdrawn.

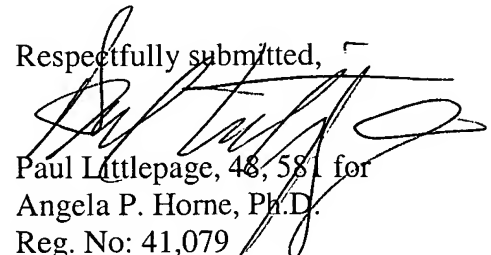
CONCLUSION

In view of the foregoing, Applicants believes all claims now pending in this application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the claims are deemed not to be in condition for allowance after consideration of this Response, a telephone interview with the Examiner is hereby requested. Please telephone the undersigned at (510) 337-7871 to schedule an interview.

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- 1) A transmittal sheet; and
- 2) Applicants Initiated Interview Request Form 413-A; and,
- 3) A receipt indication postcard.